WPS 2943

POLICY RESEARCH WORKING PAPER 2943

Capital Flows, Country Risk, and Contagion

Norbert Fiess

The World Bank
Latin America and the Caribbean Region
Office of the Chief Economist
January 2003

Abstract

It has been widely recognized that both country-specific and global factors matter in explaining capital flows. Fiess presents an empirical framework that disentangles the relative weight of country-specific and global factors in determining capital flows. In essence, his approach first separates the common component of emerging country spreads from their country-specific component. The pure country risk and global risk components are then used as explanatory variables to account for the observed pattern of capital flows using multivariate cointegration analyses. The author is able to identify the relative weight of global and country-specific factors in explaining capital flows to Argentina, Brazil, Mexico, and Venezuela in the 1990s. When further decomposing country risk into its determinants, the author finds that within a small system it is possible to jointly identify the determinants of capital flows and sovereign bond spreads. We find that capital flows are driven by country risk and global factors ("contagion" and U.S. long-term interest rates), while country risk is determined by the primary balance-to-GDP ratio (-) and the ratio of public debt to GDP (+).

This paper—a product of the Office of the Chief Economist, Latin America and the Caribbean Region—is part of a larger effort in the region to understand international capital flows. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Ruth Izquierdo, room I8-012, telephone 202-458-4161, fax 202-522-7528, email address rizquierdo@worldbank.org. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at nfiess@worldbank.org. January 2003. (28 pages)

Capital Flows, Country Risk and Contagion[1]

Norbert Fiess
nfiess@worldbank.org

World Bank

- draft, comments welcome -

JEL: F30

[1] I would like to thank Guillermo Perry and Luis Serven for invaluable discussions. I would also like to thank Santiago Herrera, Ronnie MacDonald, William Maloney, Dilip Ratah and Raskmi Shankar for comments and suggestions, and Conrado Garcia-Corrado and Ana Maria Menendez for expert research assistance.

1. Introduction

It has been widely recognized that both country-specific and global factors matter in explaining capital flows (Fernandez-Arias and Montiel 1996, Taylor and Sorno, 1997). In this paper we present an empirical framework that allows us to disentangle the relative weight of country-specific and global factors in determining capital flows using data for Argentina, Mexico, Brazil and Venezuela during the 1990s.

This paper is motivated in parts by the fact that after the Russian crisis, Latin American countries – like other emerging economies – faced a sharp decline in capital flows. The experienced decline in capital flows after the Russian crisis was general and points to an underlying global driving force, and different explanations have been brought forward for such a view (e.g. sudden stops - Calvo and Reinhard 1999). However, the recovery after 1999 was more heterogeneous, indicating that country-specific factors had an important role to play. While capital flows nearly reached pre-crisis levels in Brazil and Mexico in 1999, capital flows in Argentina and Venezuela continued to fall until 2000 and implode completely in 2001. We provide an econometric framework which allows us to implicitly assess the relative weight of country-specific and global driving forces for capital flows.

In essence, our approach separates the common component of emerging country spreads – which, loosely speaking, reflects global conditions or 'contagion', and hence captures systemic risk – from their country-specific component, which should primarily reflect each country's economic fundamentals (or, more precisely, investors' perceptions about them) and provide a measure of each country's pure risk premium. This procedure yields an indicator of global risk which we view as a summary measure of the degree of co-movement among emerging-market spreads. The pure country risk and global risk components are then used as explanatory variables to account for the observed pattern of capital flows to the countries under analysis using multivariate cointegration models (Johansen 1988). In a final step, we place restrictions on the cointegration space and identify the relative weight of global and country-specific capital flow determinants using recursive cointegration tests.

This paper also contributes to the literature on determinants of country risk as we further try to identify its underlying driving forces. We demonstrate that within a small system it is possible to jointly identify the determinants of capital flows and country risk in an economically meaningful way.

The paper is organized as follows. Section 2 derives an indicator of global risk. Section 3 estimates a model for the determinants of capital flows and assesses the relative importance of global and country-specific variables in determining capital flows. Section 4 extends Section 3 by further decomposing the country risk premium into its domestic fundamentals within a systems framework. Section 5 concludes.

1. The Global Factor versus Country Risk, a decomposition of the Spread

Sovereign bond spreads are commonly perceived as reflecting market perceptions of the risks of default, where the probability of default is related to short-term liquidity and long-term solvency risks. The determinants of default or country risk are usually approximated by economic variables related to solvency and liquidity, macroeconomic fundamentals and external shocks. Evidence of substantial co-movement in sovereign bond spreads over time indicates further that yield spreads do not only capture country-specific information but also relate to spillovers from developments in one particular country or to more general global driving factors.

It is commonly assumed that the degree of co-movement in sovereign bond spreads provides an indication of the nature of shocks to emerging capital markets. Where an increase in co-movement suggests that investors view a shock as a common "emerging market event", while a low degree of co-movement might point to a set of more idiosyncratic shocks (Cunningham et al, 2001). It seems therefore important to decompose the spread into idiosyncratic and systemic risk.

Nellis (1982), Mauro et al. (2000) and Dungey et al. (2000) use factor analysis to decompose international interest rate spreads into national and global factors. Nellis (1982) uses the extend of interest rate variation explained by the first principal component to gauge the degree of international financial integration. Mauro, Sussman and Yafeh (2000) use principal component analysis to assess the extent to which the variation in the EMBI and EMBI+ is accounted for by a common component and compare the degree of co-movement of historic spreads (1870 – 1913) to that of modern spreads (1992-2000). Dungey, Martin and Pagan (2000) use a dynamic latent factor model to identify national and global components in interest rates spreads of OECD countries.

We follow this literature and use principal component analysis to construct an indicator of global co-movement. We argue that only the idiosyncratic portion of the spread (residual of a regression of the spread on the first principal component) is country risk, while the first principal component itself (systemic component of the spread) is driven by global factors and/or contagion.[2]

We use end-of the month EMBI spreads for Argentina, Bulgaria, Brazil, Ecuador, México, Nigeria, Panama, Peru, Poland, Russia and Venezuela from January 1991 to February 2002. Data for Argentina, Brazil and Mexico is available over the whole period. Nigeria was included into the EMBI in December 1992, Venezuela in December 1993, Bulgaria and Poland in November 1994, Ecuador in July 1995, Panama in February 1997, Peru in May 1997 and Russia in August 1999.

To construct an indicator of global co-movement, we use a rolling window of 24 month and use the percentage of the variance explained by the first principle component as an indicator of global co-movement. As we use overlapping windows, each data point appears in 24 different windows. To smooth the indicator, we average over all observations. The indicator of global co-movement presented in Figure 1 represents thus the average percentage of variance explained by the first principal component at given point in time.

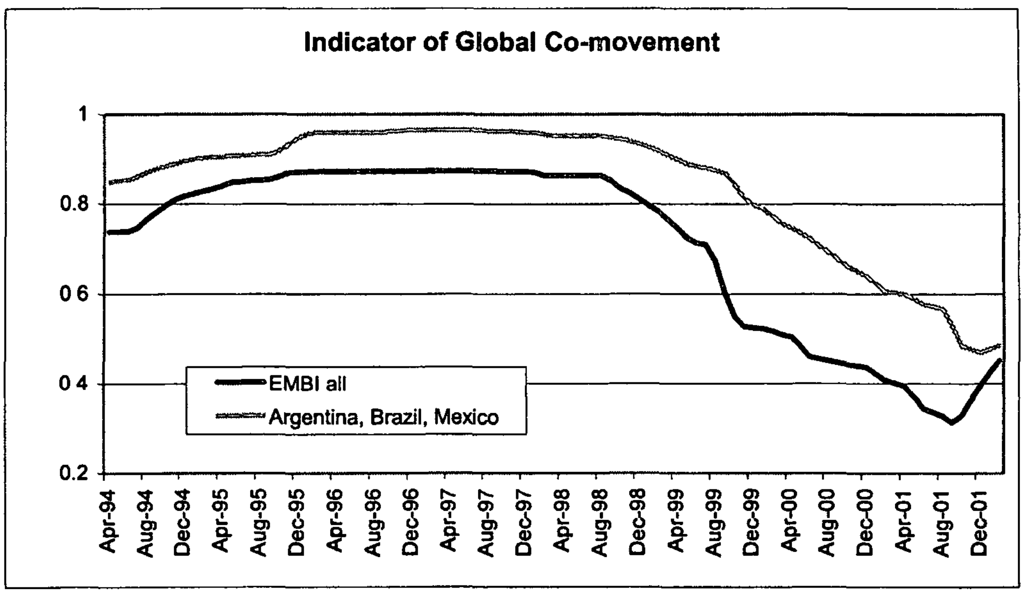
We perform a whole range of sensitivity checks. Excluding individual countries or regions does not change the results. Using different window lengths or daily data provides also a similar picture. Further, using data in levels or first differences does also not seem to change the general picture. To account for common US interest rate effects on spread co-movements, we also construct an alternative indicator, where we first regress the country spreads on US interest rate and then perform factor analysis on the residuals of these regressions. As the residuals of these regressions are orthogonal to US interest rates, this procedure eliminates any interest rate impact. The impact of this

[2] We use the term contagion quite loosely. The focus of our paper at this point is to separate country risk from global risk. We leave a further distinction between observed and unobserved components within the global driving component to further research
(see World Bank http://ddg-as4/prem/Contagion/Definitions_of_Contagion/definitions_of_contagion.html for different definitions of contagion and relevant references)

adjustment was found to be negligible. This finding is in line with existing studies on the determinants of spreads which do not find significant and robust effects of US interest rates on emerging market spreads (see e.g. Kamin and von Kleist, 1999)

Finally, we also extract the percentage of variation accounted for by the first principal component in a sample consisting of EMBI spread for Argentina, Brazil and Mexico. This indicator together with an indicator based on all EMBI spreads is plotted in Figure 1. Both indicators are highly correlated. They increase with the Tequila crisis and the Asian crisis and remain at a high level until the Russian crises. It appears that during 1996 and 1998 the percentage of variation explained by the first principal component was above 80 percent. After the Russian crisis, both indicators show a downward trend in global co-movement. The indicator based on all EMBI components is generally below the indicator of co-movement for Argentina, Mexico and Brazil[3], however, it has been strongly converging to the level of the latter since September/October 2001.[4]

Figure 1: Indicator of global co-movement



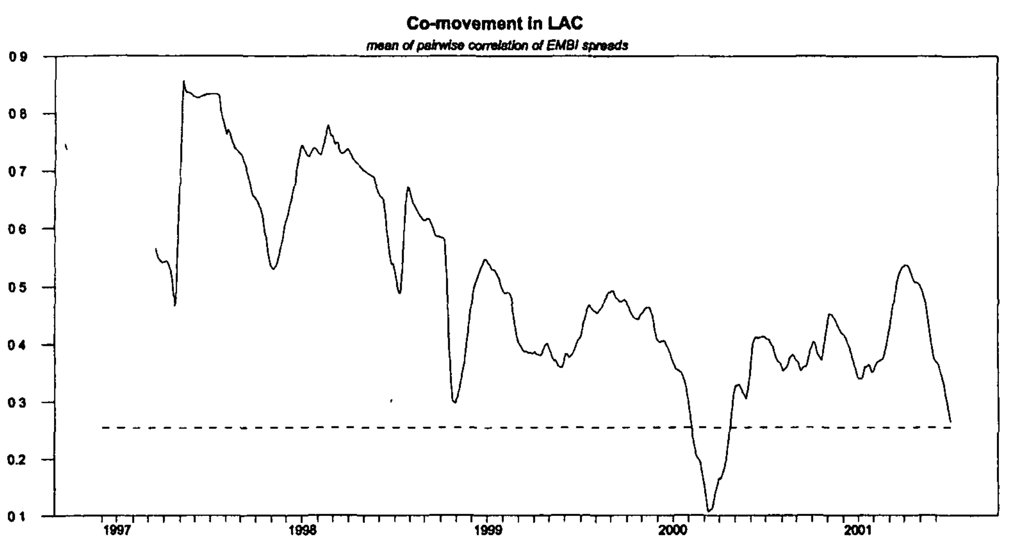
Note: EMBI all includes Argentina, Bulgaria, Brazil, Ecuador, México, Nigeria, Panama, Peru, Poland, Russia and Venezuela.

[3] This findings seems not surprising. Within a larger group of countries the number of potential driving forces is larger and as such the percentage of variation explained by the first principal component is likely to be on average smaller.

[4] Further analysis is needed to disentangle the relative weight of the impact on co-movement of September 11 and developments in Argentina at the time.

An even more simple summary measure of co-movement in country risk is the mean of bilateral correlation coefficients of changes in spreads (see Cunningham et al., 2001).[5] This measure is calculated over a rolling window of 60 daily observations. An increase in this measure signals higher co-movement of country risk. The black solid line in Figure 2 depicts this measure from January 1st, 1997 to December 30th , 2001 and shows that the degree of co-movement in LAC spreads was very high after the Asian and Russian crisis and fell substantially since, though there were some moderate rebounds after the devaluation of the Real and the building up of the Argentine crisis during 2001. A further de-linking of spreads is evident from September 2001 onwards. This simple measure broadly reveals a pattern of co-movement, which is similar to the measure of global co-movement derived from principal component analysis (see Figure 1).

Figure 2



Note: Dotted line is 5% level of significance.

[5] Sovereign bond spreads included in this analysis are for Argentina, Brazil, Chile, Colombia, Ecuador, Mexico, Panama, Peru, Uruguay and Venezuela. In the case of Chile and Uruguay, we use the Latin Eurobond Index.

2. Determinants of Capital Flows

2.1 Data

The data used here are from January 1990 to December 2001 for Argentina, Mexico and Brazil. Data for Venezuela only covers January 1996 to December 2001. The data on capital flows was obtained as in Taylor and Sarno (1997) and Mody, Taylor and Kim (2001) from the data bank of the World Bank, Development Prospects Group (DECPG). The data on capital flows is from Euromoney Bond and Loanware and comprises of monthly records of bond, equity and syndicated loan flows. Bond flows include international bond issues by private, public and secondary borrowers in the given country. Equity flows include international equity issues on the international capital market by all borrowers in the given country, while loan flows account for publicly announced syndicated loans to public and private borrowers. Country data on sovereign bond spreads were obtained from JP Morgan's EMBI database. Fiscal data are from national Central Banks. In the case of Brazil, a monthly debt-to-GDP ratio as well as a monthly primary-balance-to GDP series is published by the Banco do Brasil, the latter series is however only available from January 1995. Fiscal data for Argentina and Mexico are interpolated from quarterly data from 1994 to 2001.

2.3 Findings of Cointegration Analysis

Capital flows to developing countries can be driven either by internal, country-specific factors or external, global factors. Country-specific or 'pull' factors reflect domestic investment opportunities and risk, which attract funds from abroad. Global factors on the other hand 'push' funds towards emerging markets. Push factors are related to the level of economic activity and alternative investment opportunities in developed economies. Fernandez-Arias and Montiel (1996) introduce an analytical framework that incorporates the impact of domestic and global factors on capital flows and Taylor and Sarno (1997) show that dynamic adjustment can be formally introduced into this framework by assuming a simple cost of adjustment model. Within this framework, the long-run determinants of capital flows can be modeled as a function of country specific and global factors.

We follow Taylor and Sarno (1997) and Mody, Taylor and Kim (2001) and model gross capital inflows as a function of country-specific pull factors and global push factors. For the global factors we distinguish between systemic risk - as identified in the previous section - and US long-term interest rates. The country-specific pull factor is taken as the idiosyncratic component in the country EMBI spread. It is derived as the residual from a regression of the country EMBI components on the first principal component. This approach ensures that country risk is orthogonal to systemic risk and follows from our reasoning that only the idiosyncratic portion of the spread is country risk.[6]

Please note, when extracting the idiosyncratic and systemic part of the spread, we use the first principal component estimated over the full sample (1992-2001), i.e. we do not use a rolling window or averages of overlapping windows as in the previous section. A drawback of this approach is that we can only rely on spreads data for Argentina, Brazil and Mexico, as data for other countries become available only at a later point in time. However, this approach ensures that we do not use future information on spreads to explain present levels of capital flows.

We follow Taylor and Sarno (1997) and Mody, Taylor and Kim (2001) and model the global push factors as weakly exogenous.[7] When testing for cointegration, we use VAR models with three lags and a constant in the cointegration space. This parameterization proved sufficient to produce random errors, model specification tests are presented in Appendix 1.

Using country data for Argentina, Brazil, Mexico and Venezuela, we find evidence for one cointegration vector for all four countries (see Table 1).[8] This cointegration relationship suggests that capital flows are a negative function of country risk, global co-movement and the long-term US interest rate. Capital flows increase

---

[6] An alternative approach to extracting the idiosyncratic component of the spread could be to regress, i.e. the Argentina component of the EMBI on the overall EMBI and take the residual from this regression as country risk for Argentina. However, one draw-back of this approach is that the country component of the EMBI is part of the aggregate. We find that both approaches yield similar results.

[7] A test of weak-exogeneity also confirms such a specification.

[8] In the case of Brazil and Mexico, we cannot reject a second cointegration vector, however, as a graphical inspection of the cointegration vectors points to only one stationary cointegration vector, we restrict our analysis to one.

when country risk and systemic risk declines and when US interest rates come down.[9] This finding is in line with theoretical arguments of the pull/push factor approach, where capital flows to receiving countries increase if perceived country risk is low and if interest rate in the creditor country are low.

Table 2 reports the coefficients of the cointegration vectors and Table 3 reports the adjustment coefficients to the cointegration relationships. We find for Argentina, Mexico and Brazil that capital flows and not country risk is adjusting to a disequilibrium position, indicating that country risk is driving capital flows and not the reverse. Only for Venezuela, there is evidence that both, capital flows and country risks are adjusting to disturbances from the long-run equilibrium.

Table 1: Cointegration Trace Test

Null Hypothesis	Alternative Hypothesis	Argentina	México	Brazil	Venezuela	95% Critical Value (Reinsel-Ahn corrected)
λ_{trace} test						
$r = 0$	$r > 0$	44.61*	74.68*	57.42*	48.79*	22.09
$r \leq 1$	$r > 1$	10.50	13.95	15.36	9.14	10.70

*Rejection at the 5% level of significance. Critical Values are corrected for small sample bias using Reinsel-Ahn correction.

[9] In the case of Mexico, the coefficient on country risk is oppositely signed.

Table 2: Cointegration Coefficients

	Argentina[10]	Mexico	Brazil	Venezuela
	β	β	β	β
Capital flows	1.000	1.000	1.000	1.000
Country risk	15.581	-3.508	1.089	3.692
	(6.557)	(1.183)	(2.409)	(1.173)
Global Co-movement	1.361	1.021	2.133	1.868
	(1.195)	(0.465)	(0.895)	(0.519)
US interest rates	1.826	2.858	2.685	1.365
	(1.563)	(0.653)	(1.259)	(0.808)
Constant	-17.266	-27.654	-24.216	-7.856
	(9.666)	(4.032)	(8.432)	(4.652)

Note: Cointegration vectors are normalized on the first element. Coefficients are in vector form, as such, a positive sign on country risk, global co-movement and US interest rates indicates a negative relationship with capital flows.

Table 3 : Adjustment Coefficients

	Argentina		Mexico		Brazil		Venezuela	
	α	t-stat.	α	t-stat.	α	t-stat.	α	t-stat.
Δ Capital Flows	-0.346	-3.612	-1.149	-8.828	-0.616	-6.407	-0.462	-3.488
Δ Country Risk	-0.004	-1.302	0.001	0.225	0.000	0.059	-0.055	-5.648

Note: Δ indicates a variable in first differences.

In the next section we try to identify the relative importance of country-specific versus global factors by placing restrictions on the identified cointegration relationships. We first provide full sample evidence and then assess the stability of these restrictions over time. The latter approach allows us to identify if the weight attributed to country-specific and global capital flow determinants has shifted over time.

[10] Fore presentational purposes, coefficient estimates for Argentina are reported for the 1992:01 – 2001:08 sample. After 2001:08 the Argentina spread increase dramatically and the estimated coefficient on country risk appear much higher. However, using a slightly smaller sample changes the magnitude on the coefficient, however, not their sign or significance.

3. Hypothesis Tests: Test of long-run exclusion

An advantage of the Johansen cointegration approach is that over-identifying restrictions can be placed on the cointegration space (Johansen and Juselius 1992). In Table 4 we present full-sample evidence. Figures 3 to 8 provide the results of recursive tests for different sub-samples and allow us to investigate if domestic or global factors can be excluded as determinants of capital flows in different sub-periods.

3.1 Full-sample Evidence:

Table 4 presents the results of hypothesis tests of long-run exclusion for country risk (H1), the common component (H2) and US interest rates (H3). H4 test the hypothesis of joint exclusion of the common component and US interest rates, i.e. the hypothesis that only domestic factors matter in explaining capital flows.

Table 4: Tests of Long-run Exclusion [11]

	Argentina (1991:12- 2001:12)	**México** (1991:12- 2001:12)	**Brazil** (1991:12- 2001:12)	**Venezuela** (1996:01 - 2001:12)
H1:	$\chi^2(1) = 23.27$, p-value = 0.00	$\chi^2(2) = 5.57$, p-value = 0.02	$\chi^2(2) = 12.38$, p-value = 0.00	$\chi^2(1) = 7.81$, p-value = 0.01
H2:	$\chi^2(1) = 1.25$, p-value = 0.26	$\chi^2(2) = 3.72$, p-value = 0.05	$\chi^2(2) = 4.03$, p-value = 0.13	$\chi^2(1) = 13.31$, p-value = 0.00
H3:	$\chi^2(1) = 1.01$, p-value = 0.32	$\chi^2(2) = 7.44$, p-value = 0.01	$\chi^2(2) = 10.13$, p-value = 0.01	$\chi^2(1) = 1.00$, p-value = 0.32
H4:	$\chi^2(2) = 1.80$, p-value = 0.43	$\chi^2(4) = 9.61$, p-value = 0.01	$\chi^2(4) = 13.69$, p-value = 0.01	$\chi^2(2) = 14.78$, p-value = 0.00

The hypothesis (H1) that country risk can be excluded is strongly rejected for all four countries. The hypothesis (H4) that global factors do not matter, is clearly rejected for Mexico, Brazil and Venezuela, however cannot be rejected for Argentina.

As Table 4 show, for Argentina, Brazil, Mexico and Venezuela there is strong evidence that idiosyncratic ('pull') factors played a significant role in the observed capital inflows. This seems broadly consistent with the de-linking of country spreads mentioned

[11] The results for Argentina are not sensitive to the inclusion of 2001, if 2000:12 is used as the sample end, the respective H1, H2, H3 and H4 hypothesis test results for the 1992-2000 sample are: **H1:** $\chi^2(1) = 9.81$, (p-value = 0.00), **H2:** $\chi^2(1) = 0.02$, (p-value = 0.90), **H3:** $\chi^2(1) = 0.63$, (p-value = 0.43), and **H4:** $\chi^2(2) = 0.66$ (p-value = 0.72).

earlier. On the other hand, we do not find conclusive evidence that global ('push') factors played a major role in capital flows to Argentina. This is in contrast with the results obtained for Brazil, Mexico and Venezuela, where we do find significant evidence of global effects.

These results refer to full sample evidence for both samples, and it is revealing to examine how the model's assessment of the role of push and pull (or global and local) factors changes over time. This is done in the following section.

3.2 Sub-Sample Evidence:

In order to test the stability of the cointegration relationship over time, we perform a recursive cointegration analysis. As the number of observations for Venezuela is insufficient for a recursive analysis, we only report the results for Argentina, Mexico and Brazil. Operationally, data up to 1994:01 is used as the base period and then one observation is added until the end of the sample is reached. We test the hypothesis that the full sample estimate of $\hat{\beta}$ with different over-identifying restrictions imposed is in the space spanned by β in each sub-sample.

The results of the recursive tests are reported in Figures 3 to 8. The recursive estimation of the equations reveals that pull and push factors contributed with a different weight to the explanation of capital flows at different points in time. To save space, only provide the results of hypothesis tests H1 and H4, which test for exclusion of 'pull' and 'push' factors respectively.

The interpretation of Figures 3 to 8 is as follows. The graphs show a plot of the test for constancy of the cointegration space. When each subsample is taken individually, the test is asymptotically distributed as χ^2 with *(p-r)r* degrees of freedom, where *p* is the dimension of β and *r* is the rank of the cointegration matrix. The test statistics have been scaled by the 95% quantile in the χ^2- distribution such that unity corresponds to a test with a 5% level of significance. As such, a hypothesis test is rejected if the test statistics is above one, i.e. in Figure 3 we test for the exclusion of country risk. As this hypothesis is rejected (the null hypothesis is a cointegration vector that excludes country risk), we cannot exclude country risk from the long-run relationship. Country risk appears therefore to be an important determinant of capital flows to Argentina.

The graph clearly suggests that the contribution of push factors and pull factors changed over time. There is strong evidence that both had a significant impact on capital flows to Argentina prior to about 1996. After the Asian Crisis, only country-specific risk reaches statistical significance, while push factors become less important. Global factors become briefly significant in September 2001 (September 11 effect?), from mid 2001 onwards, there is overwhelming evidence of a significant role of country-specific risk alone.

For Brazil, we find a different pattern. Global risk appears to have lost significance after the Asian crisis (end 1997), while country risk appears to matter less after the devaluation of the Real. In Mexico, country risk matters most prior to Tequila crisis in 1994/1995, while global factors appear to influence capital flows throughout the sample. The importance of global factors in Mexico is however not explained by the systemic risk component of spreads (global co-movement) but by US interest rates (see Figure 11 and 12 in the Appendix). This finding could be related to the relative close integration of the Mexican economy with the US.

Our findings are broadly consistent with the picture pained by the two indicators of co-movement in Section 1, which show for 1997 to 2001 a gradual de-linking of country spreads in Latin America as part of a general decline in co-movement of country risk.

Figure 3: Argentina – Test of Exclusion of Country Risk ('Pull Factor')[12]

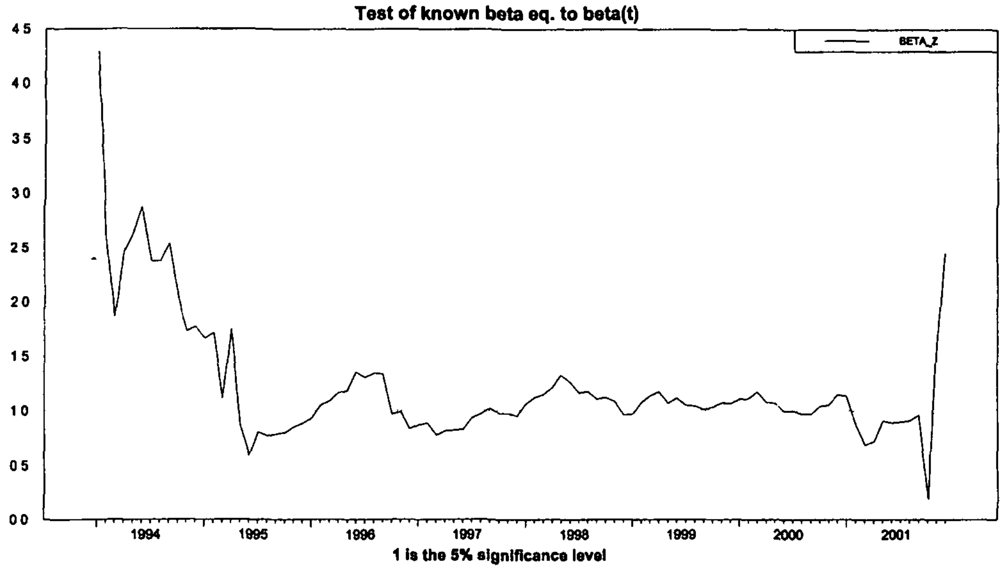
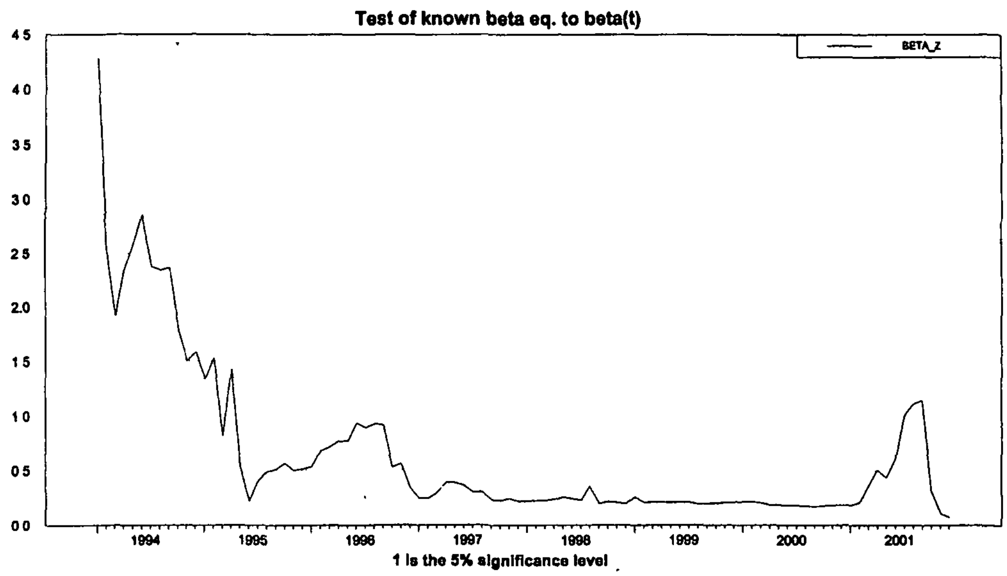


Figure 4: Argentina - Test of Exclusion of 'Push Factors'



[12] Figure 9 in Appendix 2 presents the test of exclusion of country risk based on a different subsample (1995-2001). The findings are even more significant.

Figure 5: Brazil - Test of Exclusion of Country Risk ('Pull Factor')

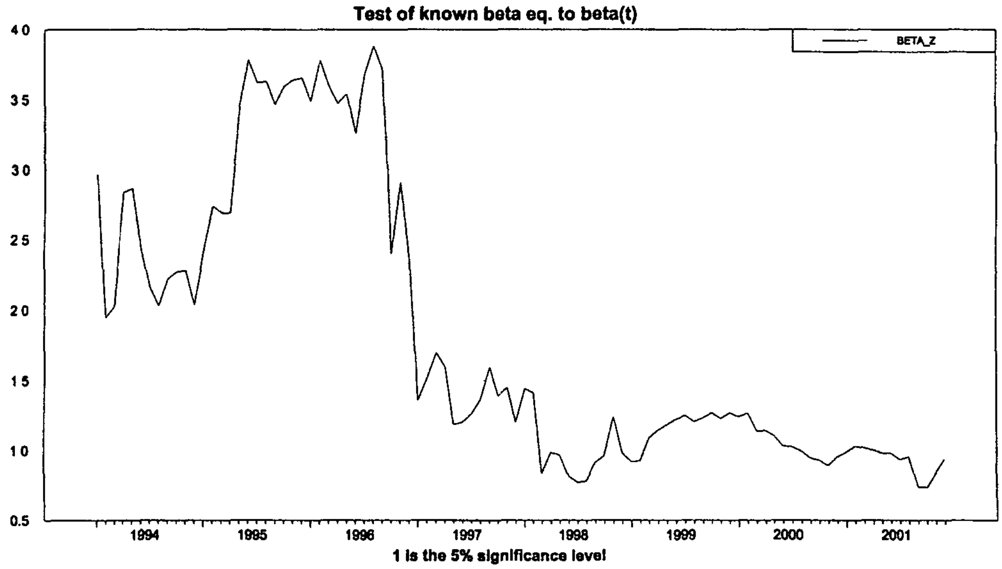


Figure 6: Brazil -Test of Exclusion of 'Push Factors'

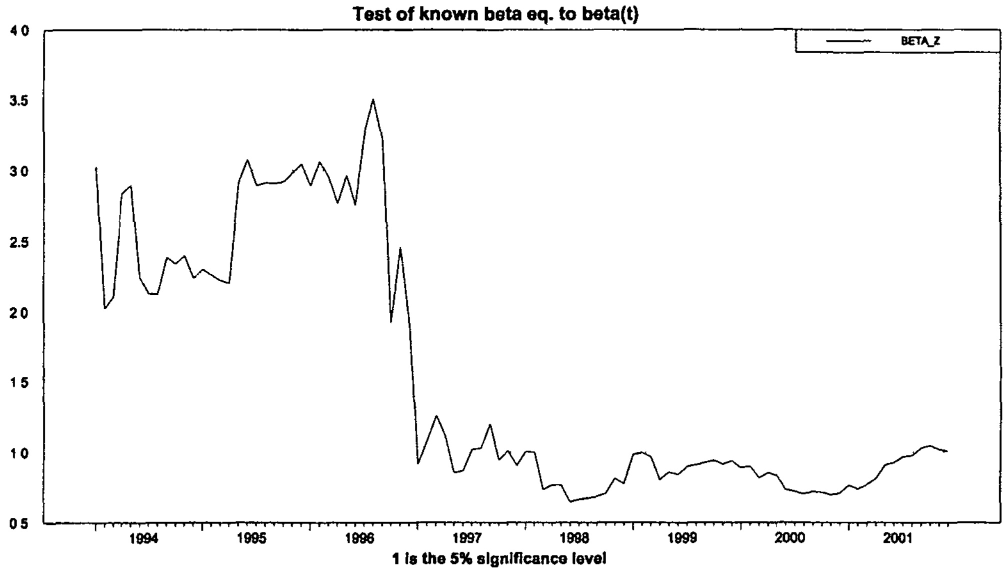


Figure 7: Mexico – Test of Exclusion of Country Risk ('Pull Factor')

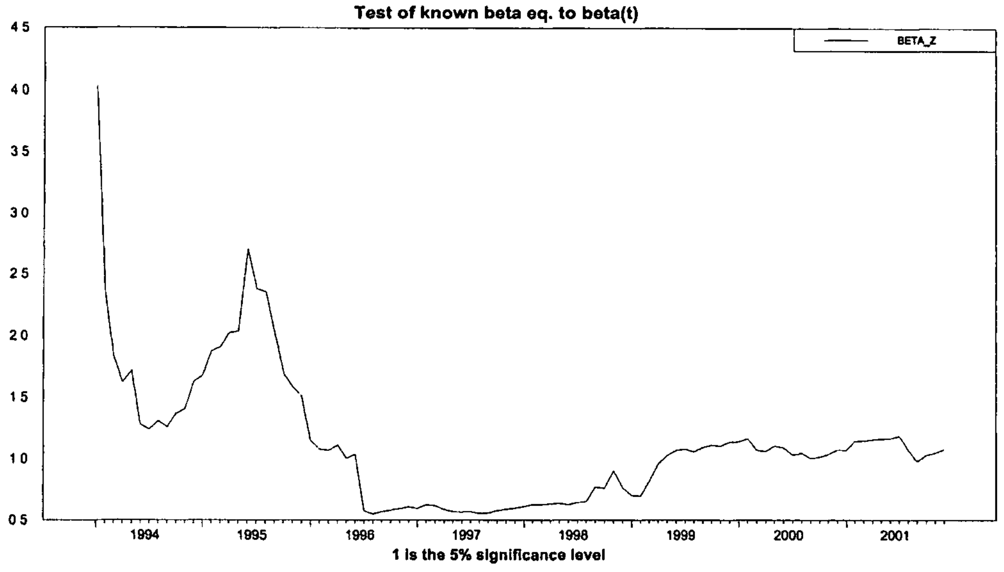
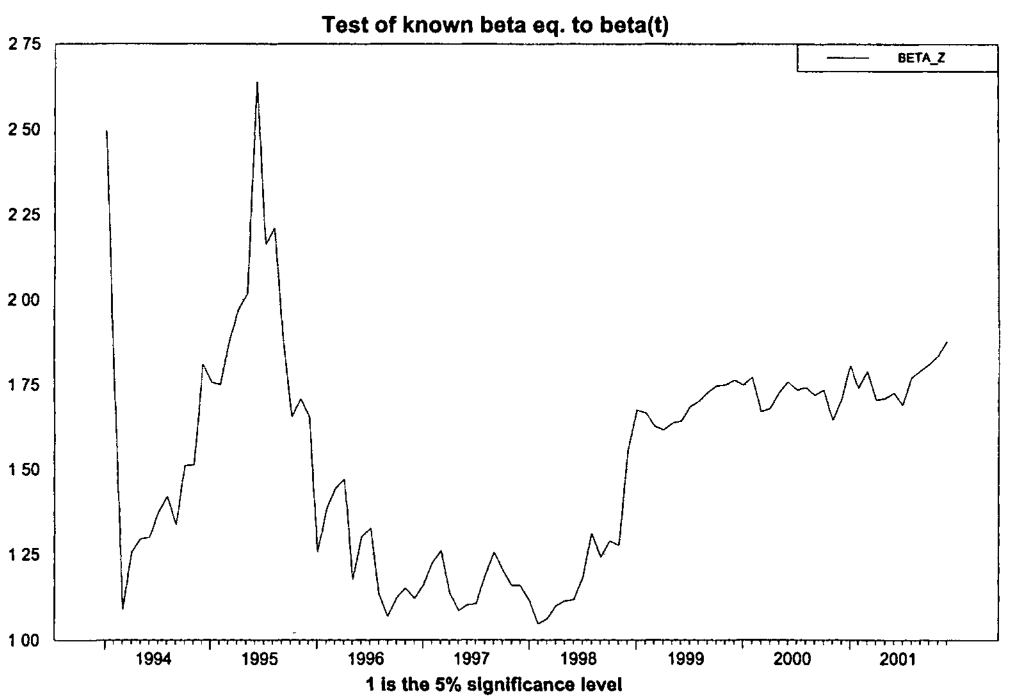


Figure 8: Mexico – Test of Exclusion of 'Push Factors'



4. Determinants of Capital Flows and Spreads – Simultaneous Identification

So far, we have established that country risk is an important determinant of capital flows and that increased country risk reduces capital inflows. In this section we try to go one step further and attempt to uncover the determinants behind country risk. In the existing literature a number of fundamentals have been suggested as possible explanators for country risk including measures of liquidity and solvency, macroeconomic fundamentals and external shocks (see e.g. Edwards 1986, Haque et al. 1996, Cline and Barnes 1997, Eichengreen and Mody 1998, Kamin and von Kleist 1999, Min 2000).

In a recent study of country credit rating, Drudi and Prati (1999) have identified the debt-to-GDP ratio and the primary balance/GPD ratio as complementary inputs in credit rating functions. Drudi and Prati (1999) establish a testable hypothesis which postulates credit rating as a negative function of the debt-to-GDP ratio and as a positive function of the primary-balance-to-GDP ratio. Such an outcome can either be the result of endogenous uncertainty on the type of the policy makers in power as in Drudi and Prati (1999) or the result of exogenous shocks to real interest rates (Missale, Giavazzi and Benigno 1997) or public expenditure (Calvo and Guidotti 1990). In Drudi and Prati (1999) the timing of fiscal correction is linked to the credit standing and the debt level of a country. Fiscal stabilization may be delayed if no incentive exists to tighten the fiscal stance, i.e. if risk premia and debt levels are below a critical threshold. As the debt stock and interest rate payments increase and credit ratings start to fall, weak and dependable governments will prefer to run primary surpluses in order to signal fiscal sustainability. Within this framework, credit ratings improve, once primary surpluses are consolidated. In models of exogenous uncertainty on the other hand, investors fear a default because a sufficiently large shock on interest rates or public expenditure might force countries to default. Within these models, a default is more likely, the higher the debt stock and the larger the primary deficit. As in the model of endogenous uncertainty, credit rating again is a negative function of the debt stock and a positive function of the primary balance.

As credit rating is directly related to country risk, we consider the debt-to-GDP ratio and the primary balance-to-GDP ratio as determinants of country risk and try to evaluate if they can be identify in our data set with the predicted sign. At this stage we are not interested in distinguishing between models of endogenous or exogenous uncertainty. Concentrating on only two determinants of country risk further ensures that we keep our multivariate system manageable from a point of view of estimation.

The model that we estimate in this section consists for each country of the following seven variables: gross capital inflows, county risk, global risk, the US long-term interest rate, the ratio of total public debt to GDP and the primary balance-to-GDP ratio. As before, we include a constant into the cointegration space and select a lag length of three. This again is sufficient to produce random errors. An advantage of a joint modeling strategy of capital flows and country risk is that we do not place *a priori* exogeneity restrictions on the variables and as such allow for simultaneity between the variables. This should yields a richer understanding of the variables driving capital flows as well as country risk.

Our VAR models identify two cointegration vectors for each country (see Table 5). We interpret the first vector as a relationship between capital flows, idiosyncratic and systemic risk and US interest rates, and the second vector as a relationship between country risk and variables of fiscal sustainability.

Table 5: Cointegration Trace Test

Null	Alternative Hypothesis	Argentina	México	Brazil	95% Critical Value (Reinsel-Ahn corrected:)	95% Critical Value
λ_{trace} test						
$r = 0$	$r > 0$	83.38*	73.93*	123.2*	65.70	53.12
$r \leq 1$	$r > 1$	46.74*	43.86*	59.85*	43.17	34.91
$r \leq 2$	$r > 2$	18.81	16.93	25.74*	24.94	20.17
$r \leq 3$	$r > 3$	8.57	6.45	7.13	11.25	9.1

*Rejection at the 5% level of significance. Critical Values are corrected for small sample bias using Reinsel-Ahn correction.

Once we place over-identifying restrictions on the cointegration space, we find that the first cointegration vector can be identified in accordance with the findings of the previous section, where capital flows was found to be a negative function of country risk and global factors (systemic risk and US long-term interest rates). The second cointegration vector relates country risk positively to the debt/GDP ratio and negatively to the primary balance-to-GDP ratio and thus provides empirical support for models of endogenous as well as exogenous uncertainty as in Drudi and Prati (1999): Country risk increases with an increasing debt stock and a decreasing balance-to-GDP ratio (see Table 6). Interestingly, the debt-to-GDP ratio and the primary balance-to-GDP ratio do not enter the capital flows equation, while capital flows, global co-movement and the US interest rate seem not to affect the pure country risk premium.

Table 6: Joint identification of determinants of capital flows and country risk

Capital flows	*Country risk*	*debt/gdp*	*Prim./gdp*	*global*	r_{us}	*const.*
Argentina: 1994:01 – 2001:12						
$\chi^2(7) = 4.13$, p-value = 0.25						
1	16.311	0	0	5.195	-0.936	-112.340
	(4.235)			(0.702)	(1.000)	(21.219)
0	1	-0.153	1.016	0	0	-2.183
		(0.055)	(0.176)			(2.021)
Brazil: 1995:01-2001:12						
$\chi^2(3) = 3.67$, p-value = 0.30						
Capital flows	*Country risk*	*debt/gdp*	*Prim./gdp*	*global*	r_{us}	*const.*
1	6.669	0	0	3.662	6.045	-53.360
	(3.041)			(0.727)	(1.812)	(11.919)
0	1	-0.039	0.018	0	0	1.179
		(0.006)	(0.024)			(0.215)
Mexico: 1994:01 –2001:12						
$\chi^2(3) = 6.61$, p-value = 0.09						
Capital flows	*Country risk*	*debt/gdp*	*Prim./gdp*	*global*	r_{us}	*const.*
1	-6.500	0	0	2.392	3.488	-32.705
	(1.413)			(0.554)	(0.795)	(4.676)
0	1	-0.218	1.746	0	0	1.349
		(0.036)	(0.036)			(0.884)

Note: A 1 indicates the variables that has been used to normalize the cointegration vector. A zero indicate that a zero restriction has been imposed on a coefficient. Standard errors in brackets. Coefficients are in vector form, as such, a positive sign on country risk, global co-movement and US interest rates indicates a negative relationship with capital flows. A negative (positive) sign for the debt-to-GDP ratio (primary surplus to GDP ratio) indicates a positive (negative) relationship with country risk.

5. Conclusion

It has been widely recognized that both country-specific and global factors matter in explaining capital flows. This paper presents an empirical framework that allows to disentangle the relative weight of country-specific and global factors in determining capital flows. In essence, our approach separates the common component of emerging country spreads from their country-specific component. The pure country risk and global risk components are then used as explanatory variables to account for the observed pattern of capital flows to the countries under analysis using multivariate cointegration analyses. We are able to identify the relative weight of global and country-specific factors in explaining capital flows to Argentina, Brazil, Mexico and Venezuela during 1990 and 2001 and, on a general note, are able to show that the degree of global co-movement as well as its weight in explaining capital flows has been declining for all countries since the Asian and Russian crisis.

We find strong evidence that idiosyncratic ('pull') factors play a significant role in the observed capital inflows. On the other hand, we do not find conclusive evidence that global ('push') factors play a major role in capital flows to Argentina. This contrasts with results obtained for Brazil, Mexico and Venezuela, where we do find significant evidence of global effects.

We further find that the contribution of push factors and pull factors has not been stable during the 1990s. Prior to the 1996, there is strong evidence that both had a significant effect on capital flows to Argentina. After the Russian Crisis, only country-specific risk reaches statistical significance, while push factors become less important. From mid 2001 onwards, there is overwhelming evidence of a significant role of country-specific risk alone.

For Brazil, we find a different picture. Country risk appears to loose significance after the Devaluation of the Real at the end of 1999, while global factors appear to matter throughout the period. In Mexico, country risks matter prior to the Tequila crisis, while US interest rates matter through out the sample, pointing to the close economic integration of Mexico with the US.

When decomposing country risk into its determinants, we find that within a small system it is possible to jointly identify the determinants of capital flows and sovereign bond spreads. We find that capital flows are driven by country risk and global factors ('contagion' and US long-term interest rates), while country risk itself is determined by domestic growth (-) and the ratio of public debt to GDP (+).

Bibliography

Bremnes, H; Gjerde, O.; Saettem, F. (1997): A multivariate cointegration analysis of interest rates in the Eurocurrency market, *Journal of International Money and Finance*, 16, 5, 767-778.

Calvo, G.; Guidotti, P. (1990): Indexation and maturity of government bonds: an explanatory model, in: Draghi, M.; Dornbusch R. (eds.): Public debt management: theory and history, Cambridge University Press.

Calvo, G.; Reinhard, C. (1999): When capital inflows come to a sudden stop: consequences and policy options, University of Maryland, mimeo. http://www.puaf.umd.edu/faculty/papers/reinhart/imfbook.pdf

Cline, W.R.; Barnes, K.J.S. (1997): Spreads and risk in emerging market lending, Research Paper 97-1, Washington D.C. Institute of International Finance.

Cunningham, A.; Dixon, L. ; Hayes, S. (2001): Analysing yield spreads on emerging market sovereign bonds, Bank of England, Financial Stability Review, December.

Dungey, M.; Martin, V.L.; Pagan, A.R. (2000): A multivariate latent factor decomposition of international bond yield spreads, *Journal of Applied Econometrics*, 15, 697-715.

Drudi, F.;Prati, A. (1999) : Signaling fiscal regime sustainability, IMF working paper, WP/99/86, forthcoming in *European Economic Review*.

Edwards, S. (1986): The pricing of bonds and loans in international markets, European Economic Review, 30, 565-589.

Eichengreen, B.; Mody, A. (1998): What explains changing spreads on emerging –market debt, NBER Working Paper No. 6408.

Fernandez-Arias, E.; Montiel, P.J. (1996): The surge of capital inflows to developing countries: an analytical overview, *World Bank Economic Review*, 10, 1, 51-77.

Forbes, K.; Rigobon, R; (1999a): No contagion, only interdependence: measuring stock market co-movement, NBER Working Paper no. 7267.

Forbes, K.; Rigobon, R; (1999b): Measuring Contagion : Conceptual and Empirical Issues, Proceedings of the World Bank Conference on International Financial Contagion, World Bank (http://ddg-as4/prem/Contagion/Forbes-Rigobon.pdf)

Haque, N.; Kumar, M.; Mark, N. Mathieson, D.J. (1996): The economic content of indicators of developing country creditworthiness, *IMF Staff Papers*, 43, 688-724.

Hendry, (1997): The econometrics of macroeconomic forecasting, *The Economic Journal*, 107, 1330-1357.

Johansen, S. (1988): Statistical analysis of cointegration vectors, *Journal of Economic Dynamic and Control*, 12, 231-254.

Johansen, S.; Juselius, K. (1992): Testing structural hypothesis in a multivariate cointegration analysis of PPP and the UIP for UK, *Journal of Econometrics*, 53, p.169-209.

Kamin, S.B.; Von Kleist, K. (1999) The evolution and determinants of emerging markets credit spreads in the 1990s, BIS Working Paper 68.

Kasa, K. (1992): Common stochastic trends in international stock markets, Journal of Monetary Economics, 29, 95-124.

Nellis, J.G. (1982): A principal component analysis of international financial integration under fixed and floating exchange rate regimes, *Applied Economics*, 14, 339-354.

Mauro, P.; Sussman, N.; Yafeh, Y. (2001): Emerging market spreads: then versus now, IMF working paper, WP/00/190, http://www.imf.org/external/pubs/ft/wp/2000/wp00190.pdf

Min, H.G. (1999): Determinants of Emerging Market Bond Spreads: Do economic fundamentals matter? World Bank, Policy Research Working Paper No. 1899. http://wb-cu.car.chula.ac.th/Papers/worldbank/wps1899.pdf

Missale. A. F.; Giavazzi, F., Benigno, P. (1997): Managing the public debt in fiscal stabilizations: the evidence, mimeo. http://papers.ssrn.com/sol3/delivery.cfm/9711121.pdf?sbtractid=41449

Mody, A.; Taylor, A.; Kim, J. (2001): Modelling fundamentals for forecasting capital flows to emerging markets, *International Journal of Finance and Economics*, 6, 201-216.

Phylaktis, K.; Ravazzola, F. (2000) : Country funds: a channel for emerging equity markets integration, City University, London. http://www.staff.city.ac.uk/s.hwang/opdf/ei.pdf

Stock, J.H.; Watson, M.W. (1988): Testing for common trends, *Journal of the American Statistical Associaton*, 83, 1097-1107.

Taylor, M.P.; Sarno, L. (1997): Capital flows to developing countries: Long- and short-term determinants, *World Bank Economic Review*, 11, 3, 451-70.

Appendix 1: Model Misspecification Tests:

Argentina:

Sample: 1992:01– 2001:12
Lag Length: 3
Dummy: 2001:08

Multivariate Statistics:	
Information Criteria	
SC	1.371
HQ	0.925
Autocorrelation	
Ljung-Box (29)	$\chi^2(104) = 86.87$
	p-value = 0.89
LM(1)	$\chi^2(4) = 5.73$
	p –value = 0.22
LM(4)	$\chi^2(4) = 3.38$
	p –value = 0.50
Normality	$\chi^2(4) = 61.97$
	p-value = 0.00

Univariate Statistics

	Skewness	Kurtosis	ARCH(3)	Normality	R^2
Capital Flows	0.5925	3.019	0.206	9.668	0.511
Country Risk	-0.5402	7.669	11.298	51.416	0.801

Argentina:

Sample: 1995:01– 2001:12
Lag Length: 3
Dummy: 2001:08

Multivariate Statistics:	
Information Criteria	
SC	1.287
HQ	0.791
Autocorrelation	
Ljung-Box (20)	$\chi^2(70) = 50.17$
	p-value = 0.96
LM(1)	$\chi^2(4) = 13.63$
	p –value = 0.01
LM(4)	$\chi^2(4) = 2.83$
	p –value = 0.59
Normality	$\chi^2(4) = 8.3$
	p-value = 0.07

Univariate Statistics

	Skewness	Kurtosis	ARCH(3)	Normality	R^2
Capital Flows	0.410188	2.654178	1.324	3.792	0.509
Country Risk	-0.192372	3.715764	8.433	3.920	0 909

Mexico
Sample: 1992:01–2001:12
Lag Length: 3
Dummies 1996:07 , 1997:06, 1998:03

Multivariate Statistics:	
Information Criteria	
SC	1.303
HQ	0.857
Autocorrelation	
Ljung-Box (29)	$\chi^2(106) = 122.01$
	p-value = 0.14
LM(1)	$\chi^2(4) = 1.656$
	p –value = 0.80
LM(4)	$\chi^2(4) = 1.906$
	p –value = 0.75
Normality	$\chi^2(4) = 34.54$
	p-value = 0.00

Univariate Statistics

	Skewness	**Kurtosis**	**ARCH(3)**	**Normality**	R^2
Capital Flows	0.9056	4.0127	2.102	17.312	0.75
Country Risk	-0.6212	5.2879	3.469	16.424	0.10

Brazil:
Sample: 1992:01–2001:12
Lag Length: 3
Dummy: 1997:06

Multivariate Statistics:	
Information Criteria	
SC	1.487
HQ	1.032
Autocorrelation	
Ljung-Box (23)	$\chi^2(82) = 79.1$
	p-value = 0.57
LM(1)	$\chi^2(4) = 3.25$
	p –value = 0.52
LM(4)	$\chi^2(4) = 0.84$
	p –value = 0.93
Normality	$\chi^2(4) = 18.65$
	p-value = 0.00

Univariate Statistics

	Skewness	**Kurtosis**	**ARCH(3)**	**Normality**	R^2
Capital Flows	0.935959	5.343343	5.102	12.825	0.675
Country Risk	0.208850	3.954908	13.980	5.856	0.102

Venezuela
Sample: 1996:01–2001:12
Lag Length: 3
Dummy: 1998:08

Multivariate Statistics:	
Information Criteria	
SC	0.085
HQ	-0.498
Autocorrelation	
Ljung-Box (15)	$\chi^2(50) = 60.8$
	p-value = 0.14
LM(1)	$\chi^2(4) = 7.169$
	p –value = 0.13
LM(4)	$\chi^2(4) = 10.136$
	p –value = 0.04
Normality	$\chi^2(4) = 17.805$
	p-value = 0.00

Univariate Statistics

	Skewness	**Kurtosis**	**ARCH(3)**	**Normality**	R^2
Capital Flows	1.20395	5.15462	3.543	13.772	0.408
Country Risk	0.66394	3.58234	0.465	4.783	0.861

Appendix 2:

Figure 9: Argentina - exclusion of pull factor (1995 - 2001)

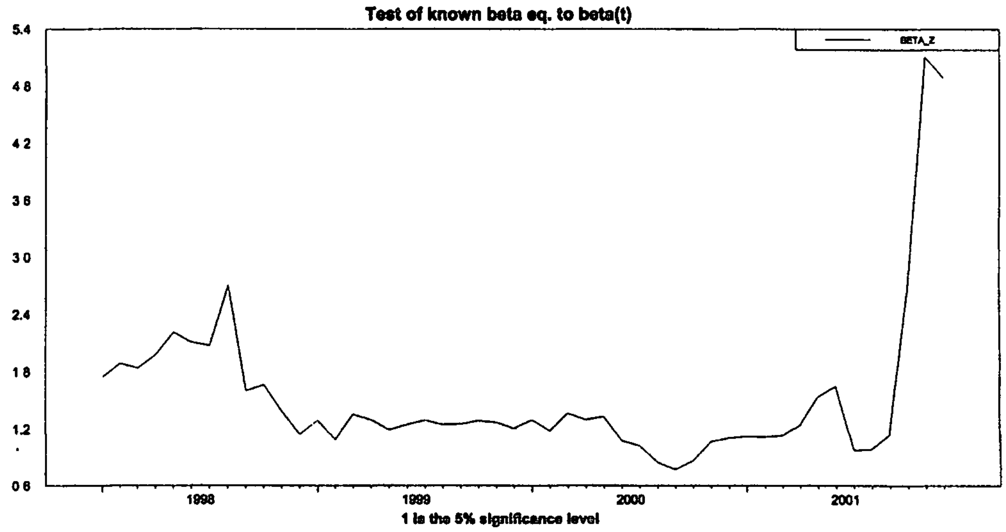


Figure 10: Mexico - Exclusion of Global Co-movement

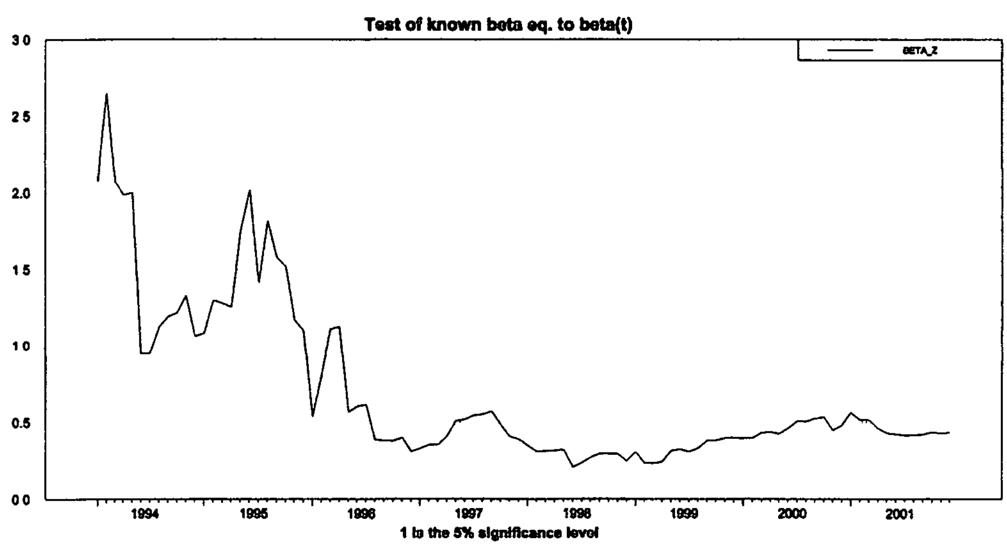
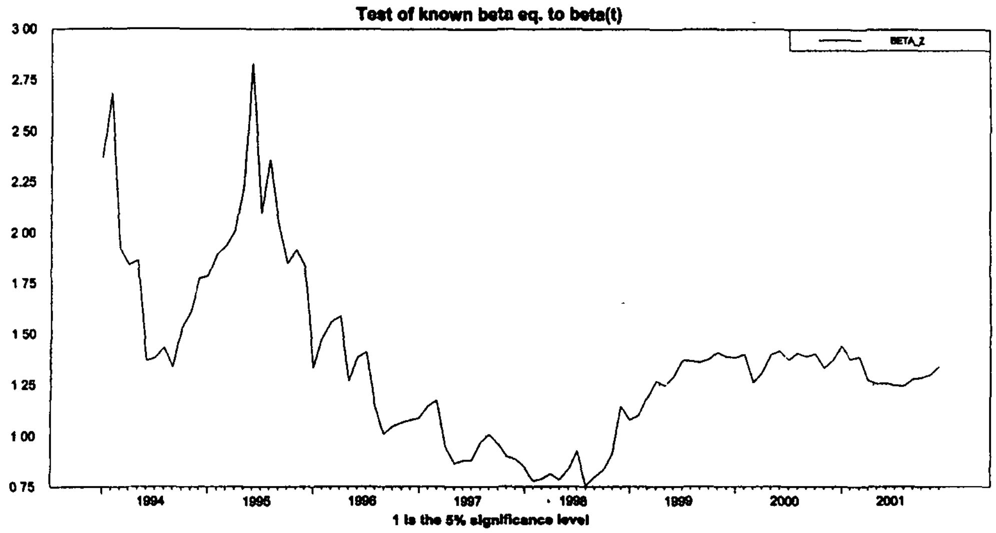


Figure 11: Mexico - Exclusion of US - Interest rate



Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS2923	Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers through Backward Linkages	Beata K Smarzynska	October 2002	P Flewitt 32724
WPS2924	Financial Development, Property Rights, and Growth	Stijn Claessens Luc Laeven	November 2002	R Vo 33722
WPS2925	Crime and Local Inequality in South Africa	Gabriel Demombynes Berk Özler	November 2002	P Sader 33902
WPS2926	Distinguishing between Observationally Equivalent Theories of Crises	Rashmi Shankar	November 2002	P Holt 37707
WPS2927	Military Expenditure Threats, Aid, and Arms Races	Paul Collier Anke Hoeffler	November 2002	A Kitson-Walters 33712
WPS2928	Growth without Governance	Daniel Kaufmann Aart Kraay	November 2002	K Morgan 37798
WPS2929	Assessing the Impact of Communication Costs on International Trade	Carsten Fink Aaditya Mattoo Ileana Cristina Neagu	November 2002	P Flewitt 32724
WPS2930	Land Rental Markets as an Alternative to Government Reallocation? Equity and Efficiency Considerations in the Chinese Land Tenure System	Klaus Deininger Songqing Jin	November 2002	M Fernandez 33766
WPS2931	The Impact of Property Rights on Households' Investment, Risk Coping, and Policy Preferences Evidence from China	Klaus Deininger Songqing Jin	November 2002	M Fernandez 33766
WPS2932	China's Accession to the World Trade Organization The Services Dimension	Aaditya Mattoo	December 2002	P Flewitt 32724
WPS2933	Small- and Medium-Size Enterprise Financing in Eastern Europe	Leora F Klapper Virginia Sarria-Allende Victor Sulla	December 2002	A. Yaptenco 31823
WPS2934	After the Big Bang? Obstacles to the Emergence of the Rule of Law in Post-Communist Societies	Karla Hoff Joseph E Stiglitz	December 2002	A Bonfield 31248
WPS2935	Missed Opportunities. Innovation and Resource-Based Growth in Latin America	William F Maloney	December 2002	P Soto 37892

Policy Research Working Paper Series

	Title	Author	Date	Contact for paper
WPS2936	Industrial Ownership and Environmental Performance. Evidence from China	Hua Wang Yanhong Jin	December 2002	Y. D'Souza 31449
WPS2937	The Determinants of Government Environmental Performance. An Empirical Analysis of Chinese Townships	Hua Wang Wenhua Di	December 2002	Y. D'Souza 31449
WPS2938	Recurrent Expenditure Requirements of Capital Projects: Estimation for Budget Purposes	Ron Hood David Husband Fei Yu	December 2002	M. Galatis 31177
WPS2939	School Attendance and Child Labor in Ecuador	Gladys López-Acevedo	December 2002	M Geller 85155
WPS2940	The Potential Demand for an HIV/ AIDS Vaccine in Brazil	Hillegonda Maria Dutilh Novaes Expedito J. A. Luna Moisés Goldbaum Samuel Kilsztajn Anaclaudia Rossbach José de la Rocha Carvalheiro	December 2002	H. Sladovich 37698
WPS2941	Income Convergence during the Disintegration of the World Economy, 1919–39	Branko Milanovic	January 2003	P. Sader 33902
WPS2942	Why is Son Preference so Persistent in East and South Asia? A Cross-Country Study of China, India, and the Republic of Korea	Monica Das Gupta Jiang Zhenghua Li Bohua Xie Zhenming Woojin Chung Bae Hwa-Ok	January 2003	M Das Gupta 31983